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ENERGY AND CLIMATE PLANS TOWARD A LOW-CARBON FUTURE IN THE EUROPEAN UNION: A COMPARATIVE STUDY

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Abstract

The European Commission has implemented measures to speed Europe's transition to low-carbon energy. In 2014, E.U. member states agreed to reduce greenhouse gas emissions by at least 40% by 2030 compared to 1990. Binding greenhouse gas emission targets from 2021 to 2030, E.U. member states are responsible for determining how to achieve the 2030 target and implementing climate-change mitigation measures. All E.U. member states have pledged to develop national energy and climate plans according to the regulations on the governance of the Energy Union and Climate Action (EU) 2018/1999. This paper compares the energy and climate plans of the European Union and systemizes the critical policies for mitigating climate change in the energy sector. Furthermore, a comprehensive multicriteria method is applied to compare the success rates of E.U. countries in achieving their national targets. The results indicated that Estonia was the best country in terms of success rate, followed by Latvia.

Keywords: *National energy and climate plan; Renewables; Energy transition; multicriteria analysis*

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1 INTRODUCTION

Energy's impact on climate change presents significant challenges for the environment, economies and societies (Diallo, 2024). It has been seen as a catalyst for a second energy revolution that seeks a low-carbon future. The European Union (EU) has also recognized the importance of energy and environmental issues, leading to the European Commission's decision in 2020 to take an unprecedented step towards a "zero-carbon" economy, motivating the EU to develop the National Energy and Climate Plan (NECP) (Le Quéré et al., 2020). The

NECP is a strategic roadmap for E.U. member states to navigate the transition to clean energy and achieve ambitious climate goals. Following the governance regulation, each country outlines its policies and measures to decarbonize its economy, improve energy efficiency, bolster energy security, integrate the internal energy market, and foster innovation in clean technologies (Zell-Ziegler et al., 2021). The NECP draft was initially submitted in 2019 and was finalized in 2020 after review by the European Commission. These plans provide a transparent view of national progress and are essential for coordinating efforts across the EU to achieve shared climate and energy objectives (CAN Europe, 2023).

Furthermore, the Russian invasion of Ukraine has had a profound impact on the EU's energy goals, causing significant disruption. This war has led to unforeseen energy price fluctuations and supply chain interruptions, threatening energy security and making the transition from fossil fuels, particularly Russian gas, even more challenging. Amidst the ongoing instability caused by the Russian invasion of Ukraine, conducting thorough progress assessments of E.U. countries' strides towards a low-carbon energy transition becomes increasingly crucial, as outlined in their NECPs (Plan, 2018). These assessments serve as a potent resource for navigating the present challenges and ensuring the EU stays on course to meet its climate objectives. Assessing progress is critical to adapting NECPs to the ever-changing global landscape (Zervas et al., 2021). These evaluations offer valuable insights that can serve as a solid basis for updating NECPs to reflect the shifting energy landscape. According to the updated plans, the assessment process may involve setting new targets, revising policy measures, and allocating additional resources to accelerate moving away from Russian fossil fuels (Maris & Flouros, 2021).

Considering the importance of progress assessment, Streimikiene et al. (2022) conducted a comprehensive systematic review of the energy and climate plans of the Baltic states to systematize the central climate-change mitigation policies in the energy sector that are targeted towards the household sector. They concluded that the progress in achieving the objectives is wider than the national level but also assists in developing policies and actions that benefit the environment. These policies aim to reduce greenhouse gas emissions and leave a positive environmental impact. However, they included only Baltic states in their analysis, while the present study would include the E.U. countries to analyze NECPs comprehensively. Also, Zell-Ziegler et al. (2021) conducted a comprehensive analysis to determine how much European governments adhere to energy sufficiency, one of the energy sustainability strategies. This analysis systematically reviewed European NECPs and long-term strategies (LTSs). They concluded that the French and Austrian cases are the two most advanced E.U. member states according to measures for energy sufficiency, included in NECPs and LTSs. However, they only focused on energy sufficiency, while the present study investigates energy efficiency and renewable energy strategies by comparing the E.U. countries' performance and NECPs and would investigate the best countries' profiles to understand how they might inspire other E.U. countries.

Considering the aforementioned research gaps and the role of NECPs in transitioning to a low-carbon future, this study aims to conduct comparative analyses to evaluate the national targets and measures of the E.U. countries toward a low-carbon future and assess their performance accordingly. To this end, a systematic review was conducted on NECPs to analyze all developed targets and measures, and secondly, a multicriteria analysis was conducted to evaluate E.U. countries' performance in reaching their national targets.

The structure of this paper is as follows: section 2 presents the dimensions of a national energy and climate plan. Research methods are presented in section 3. Section 4 presents results using charts and tables. A discussion of the results is presented in section 5. A broad conclusion is presented in section 6.

2 THEORETICAL BACKGROUND

The NECP entails each member's implementation of E.U. directives, focusing on spatial planning as a critical factor in reaching the 2030 objectives. Renewable energy sources further enhance the technical potential of all land-use types. The national plans outline how the E.U. countries intend to address the five dimensions of the energy union: **Decarbonization.** It is an essential component of the global effort to combat climate change. In this regard, the E.U. member states have pledged to set ambitious targets and implement effective strategies to reduce greenhouse gas emissions from the energy sector. **Energy efficiency:** It aims to decrease the overall energy demand across various sectors, such as buildings, industry, and transportation. Energy efficiency requires technological innovations and regulatory adjustments to create market incentives for cleaner energy adoption (Paleari, 2022). **Energy Security:** Establishing a well-diversified energy sector is a crucial objective for many countries. Such a sector would rely less on external suppliers and ensure greater energy security. **Internal Energy Market:** Removing barriers to electricity and gas trade between E.U. countries is crucial to ensure a secure and competitive energy market for businesses and consumers.

However, differences among member states in implementing energy market strategies might be challenging (Mišík & Oravcová, 2022). This study focused on this challenge by analyzing how each country's policies could be aligned with broader E.U. energy security objectives. **Research, Innovation, and Competitiveness:** The plans by various governments and organizations aim to foster investment in research and development of new energy technologies. By prioritizing research and innovation, it is expected that new and improved technologies will emerge, which can help reduce the reliance on traditional fossil fuels and mitigate the negative impact of climate change (European Commission, 2018). However, current studies focus on technological advancements without adequately addressing policy and market barriers. This study critically examined how NECPs can bridge this gap by creating regulatory and economic conditions for new energy technologies.

Implementing NECPs in the EU is associated with complex challenges in achieving variable renewable electricity targets (Newbery, 2021). A study on Greece's greenhouse gas emissions showed the need for a combined approach to reducing emissions in NECPs (Tsepi et al., 2024). Technical challenges were widely studied; however, limited research has analyzed the trade-offs between grid stability and renewables across the EU. This study addressed this limitation by assessing how NECPs manage these trade-offs. Also, the final version of NECPs has revealed a considerable variation in member states' strategies. The reactions of the E.U. member states are diverse, and most critical components are only partially addressed while other elements remain unexplored (Maris & Flouros, 2021). Moreover, NECPs should promote cooperation between sectors to improve climate resilience (Kyriakopoulos & Sebos, 2023). However, there is insufficient analysis of how well different NECPs help achieve long-term E.U. climate goals. This paper compares national NECPs and evaluates how well they align with E.U. sustainability targets.

Also, it is shown that different viewpoints can create an effective energy-efficiency plan. This plan should be balanced, realistic, and cost-effective, fitting within the broader framework of NECPs (Gkonis et al., 2020). For instance, the European Central Bank is gradually integrating climate risks into its financial supervision frameworks to ensure the resilience of energy transition investments (Deyris, 2023). Additionally, NECPs should consider social equity to ensure everyone has access to climate policies (Streimikiene et al., 2021). However, financial plans in NECPs often ignore social inequalities. This study examines how financial tools can help ensure NECPs support a fair and inclusive transition.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

A comprehensive systematic review has been undertaken to analyze the content of the EU's NECPs using a comparative assessment of renewable targets and policies. Countries were selected based on the accessibility and completeness of their NECPs as outlined by the European Commission. The study included countries representing different levels of renewable energy adoption and integration. Moreover, countries were chosen to reflect varying degrees of policy effectiveness in meeting their climate and energy targets. Also, countries were chosen from different regions within the EU to capture regional differences in energy transition strategies.

Furthermore, the review covers implemented policies promoting RES in the EU and thoroughly examines additional climate-change mitigation and energy policy documents from E.U. member countries. This information was included to ensure the review understood RES targets and their implementation results completely. The review also aimed to jointly examine planned and implemented policies presented in the NECP of selected countries, thus ensuring the consistency of the review. The systematic review approach was chosen because it can synthesize and critically evaluate many policy documents. This approach provides a structured and transparent comparative analysis of renewable energy policies across E.U. member states. This methodology ensures that the study provides an objective and replicable assessment of RES targets, avoiding potential biases.

The comparative assessment in this study takes a unique approach, beginning with comparing RES and other related targets across countries. This approach is followed by comparing trends in RES and implementing other targets, focusing on identifying similarities, differences, and underlying reasoning. A critical review of implemented and planned climate change mitigation and RES promotion policies was then performed, and policy recommendations were developed. This approach provides a fresh perspective and enhances understanding of the EU's complex landscape of RES targets and policies. The comparative methodology was selected because it allows cross-country benchmarking. Therefore, this study could show how effective policies and regulations and socioeconomic factors impact the use of renewable energy.

One of the strengths of the applied comparative assessment was its simplicity and ease of use, which enabled both quantitative data analysis and qualitative interpretation of outcomes. The systematic analysis offered a comprehensive view of the implementation of RES targets and their effectiveness in mitigating climate change.

A multicriteria framework provides a structured way to incorporate various factors into the analysis (Streimikis, 2025). Here, an MCDM method called CRITIC-SAW ranks the E.U. countries according to their success rate in achieving their national targets. In the following, the steps of the multicriteria decision-making method are presented. MCDM methods were applied to objectively and quantitatively analyze E.U. countries based on multiple performance indicators.

The CRITIC method is applied to determine the objective weights of criteria in this research, and the SAW method ranks all our alternatives, which are countries in this study, according to weighted criteria. The CRITIC method ensures that the determining weights remain data-driven and minimize subjectivity, while the SAW method provides a straightforward ranking mechanism. This combination allows for a robust and transparent evaluation of national progress toward RES targets. This integrated method was applied in previous research. For instance, Hassan et al. (2023) applied the CRITIC- technique for order of preference by similarity to ideal solution (TOPSIS) to select the best locations for solar farms and compared their model with CRITIC-SAW. Also, Nabavi et al. (2023) applied CRITIC-SAW to perform a sensitivity analysis of multi-criteria decision-making methods for engineering applications.

CRITIC-SAW

Step 1. Decision matrix construction (Hassan et al., 2023; Saraji et al., 2021)

Consider a set of the E.U. countries denoted by $\{c_1, c_2, \dots, c_m\}$, and a set of criteria denoted by $\{I_1, I_2, \dots, I_n\}$; $thus, \mathbb{Z} = \left(x_{ij}\right)_{m\times n}$. Let $x_{ij}\ \forall\, i = 1, \dots, m; j = 1, \dots, n$ represent the given value to the i_{th} country according to the j_{th} criteria.

Step 2. Normalization for CRITIC

Equation 1 normalizes $\mathbb{N} = \left(\bar{x}_{ij}\right)_{m\times n}$ for the CRITIC, where $x_j^- = \min_i x_{ij}$ and $x_j^+ = \max_i x_{ij}$, and b and n indicate benefit and cost criteria respectively.

$$\bar{x}_{ij} = \begin{cases} \dfrac{x_{ij} - x_j^-}{x_j^+ - x_j^-}, j \in N_b \\ \dfrac{x_j^+ - x_{ij}}{x_j^+ - x_j^-}, j \in N_n \end{cases} \qquad 1$$

Step 3. Information quantity

The calculation of the information quantity Q_j can be derived through the utilization of equation 2, where σ_j shows the standard deviation and r_{jt} shows the correlation between vectors $\bar{x}_j$ and $\bar{x}_k$. In this study, the Pearson correlation is used.

$$Q_j = \sigma_j \left(\sum_{t=1}^{n} (1 - r_{jt}) \right) \quad 2$$

Step 4. Final weights

Equation 3 calculates the final weights (ϖ_j).

$$\varpi_j = \frac{Q_j}{\sum_{i=1}^{m} Q_j} \quad 3$$

Step 5. Normalization for SAW

Equation 4 normalizes the decision-making for the SAW method. All criteria in this research are beneficial.

$$\bar{\bar{x}}_{ij} = \frac{x_{ij}}{Max\ x_{ij}} \quad 4$$

Step 5. Performance values

Equation 3 calculates the performance values (V_i) for alternatives,

$$V_i = \sum_{j=1}^{n} \varpi_j . \bar{\bar{x}}_{ij} \quad 5$$

where V_i determines the ranking for each alternative, ϖ_j is the weighted value of each criterion; $\bar{\bar{x}}_{ij}$ is the normalized performance rating value. A larger *Vi* value indicates that the alternative c_i is preferred.

4. RESULTS

4.1. Comparative Assessment of Climate and Energy Targets Set in NECPs

The main targets for greenhouse gas (GHG)-emission reduction, renewable energy share (RES), and energy efficiency for 2020 and 2030 are presented in the following tables. The main targets set in the NECPs are as follows:

- Member state greenhouse gas emission limits, compared to 1990 level;
- Share of renewables in gross final energy consumption;
- Use of renewables in transport;
- Primary energy consumption;
- Final energy consumption.

4.1.1. Nordics and Baltics

Table 1 compares GHG reduction, renewable energy use, and energy efficiency targets for Nordic and Baltic countries in 2020 and 2030.

Tab. 1 - Nordics and Baltics targets. Created by authors based on references (Ekonomikas ministrija, 2019; Energi-og Forsyningsministeriet, 2019; European Commission, 2020g, 2020h, 2020i, 2020p, 2020q, 2020x; Majandus- ja Kommunikatsiooniministeerium, 2019; Ministry of economic affairs and employment, 2019; Ministry of energy, 2019b)

Country	Target	Member state greenhouse gas emission limits, compared to 1990, %	Share of renewables in gross final energy consumption, %	Share of renewables in transport, %	Primary energy consumption (PEC), Mtoe	Final energy consumption (FEC), Mtoe
EU	2020	-20%	20%	10.20%	1483	959
	2030	At least -55%	32%	29%	992.5	763
	Implementation 2020	-20%	22%	10.30%	1235.8	906.3
DK	2020	-34%	30%	10.1%	17.5	15.2
	2030	-70%	70%	38%	18.33	15.78
	Implementation 2020	-40.18%	31.60%	9.7%	15.3	13.1
SE	2020	-40%	49%	13.80%	43.4	30.3
	2030	-63%	65%	47.70%	40.16	29.67
	Implementation 2020	-35.26%	60.10%	31.9%	41.70	30.9
FI	2020	EU Target level	38%	20%	35.9	26.7
	2030	EU Target level	50%	30%	34.8	24.9
	Implementation 2020	-32.62%	43.80%	14.3%	29.9	23.3
LT	2020	EU Target level	23%	10%	6.5	4.3
	2030	EU Target level	45%	15%	5.4	4.5

	Implementation 2020	-58.7%	26.80%	5.5%	6.2	5.3
LV	2020	EU Target level	40%	10%	5.4	4.5
	2030	-65%	50%	7%	4.1	3.6
	Implementation 2020	-59.39%	42.10%	6.7%	4.3	3.9
EE	2020	EU Target level	25%	10%	5.50	2.90
	2030	-70%	40%	14%	5.4	2.9
	Implementation 2020	-71.57%	30.20%	12.2%	4.30	2.80

Table 1 shows the E.U.-set greenhouse gas emission limits for Nordics and Baltics in 2020 compared to 1990. It also shows the implementation of these limits as well. Estonia (EE) exceeded its target, reducing emissions by 71.57% in 2020. Finland (FI) also exceeded its target, reducing emissions by 32.62% in 2020. Latvia (LV) exceeded its target, reducing emissions by 59.39% in 2020. Lithuania (LT), Sweden (SE), and Denmark (DK) also exceeded their targets. Lithuania reduced emissions by 58.7%, Sweden reduced emissions by 32.26%, and Denmark reduced emissions by 40.18%. The EU has set a more ambitious target for 2030, aiming for at least a 55% reduction in greenhouse gas emissions compared to 1990. Table 1 shows the targets that some member states have set for themselves for 2030. The Nordics and Baltics have varying targets for reducing greenhouse gas emissions by 2030, with Denmark and Estonia aiming for the most significant reduction at 70%, followed by other Nordic and Baltic countries. Moreover, table 1 shows the share of renewables in gross final energy consumption for Nordics and Baltics. It also shows the target share for 2030 and the implementation level in 2020. All countries listed have a lower percentage of renewable energy consumption in 2020 than their target share for 2030. Denmark, Sweden, and Finland have the highest percentage of renewables in their energy consumption, with Denmark at 31.60%, Sweden at 60.10%, and Finland at 43.80%. Lithuania, Estonia, and Latvia all consume less renewable energy. The EU has a target of 32% renewables in gross final energy consumption by 2030. In 2020, the implementation level was only 22%. Also, regarding the share of renewables in gross final energy consumption in 2020 compared to their set targets for 2020, most countries achieved or surpassed their goals for 2020. While Denmark slightly exceeded their target of 30% with an actual value of 31.6%, all other countries significantly achieved theirs. The EU reached 22%, surpassing its 20% target; Sweden went well above their target of 49% by reaching 60.1%, and Finland landed at 43.8%, higher than their 38% goal. Similarly, Lithuania, Latvia, and Estonia exceeded their set targets for 2020. Furthermore, The EU aims to nearly triple the share of renewables in transport by 2030 (29% target), exceeding their previous 10% target in 2020 (10.3% achieved). Individual countries within the EU have varying ambitions, with Denmark aiming for 38% by 2030 (falling short of the 10% target in 2020), Finland exceeding their 2020 target (14.3% achieved) with a 30% goal for 2030, and the Baltic states like Lithuania (5.5% in 2020, 15% target for 2030), Latvia (exceeding the 2020 target with 6.7%, aiming for 7% by 2030), and Estonia (surpassing the 2020 target at 12.2%, with a 14% target for 2030) showcasing a range of progress towards a more sustainable transport sector.

Moreover, regarding energy efficiency targets, Sweden's primary and final energy consumption stats were 41.70 and 30.9 Mtoe in 2020, while its targets for 2020 were 43.4 and 30.3 Mtoe. The same stats were for Finland at 29.9 and 23.3 Mtoe and Denmark at 15.3 and 13.1 Mtoe in 2020, while Finland's targets for primary and final energy consumption stats were 35.9 and 26.7 Mtoe, and Denmark's targets were 17.5 and 15.2 Mtoe in 2020. Estonia's primary and final energy consumption stats were 4.3 and 2.8 Mtoe in 2020, while its targets for 2020 were 5.5 and 2.2 Mtoe. The same stats were for Lithuania at 6.20 and 5.3 Mtoe and Latvia at 4.3 and 3.9 Mtoe in 2020, while Lithuania's targets for primary and final energy consumption stats were 6.5 and 4.3 Mtoe, and Latvia's targets were 5.4 and 4.5 Mtoe in 2020. Moreover, countries in the Nordics and Baltics have various targets for primary energy consumption for 2030, varying from 40.16 Mtoe for Sweden to 4.1 Mtoe for Lithuania. Also, various targets for final energy consumption are set for 2030, varying from 29.67 Mtoe for Sweden to 2.9 Mtoe for Estonia.

4.1.2. Western Europe

Table 2 presents climate and energy targets for western European countries, highlighting their performance in GHG reductions, renewable energy adoption, and energy efficiency.

Tab. 2 - Western Europe targets. Created by authors based on references (European Commission, 2020a, 2020b, 2020j, 2020k, 2020r, 2020y; Federal ministry for sustainability and tourism, 2019; Le gouvernement du grand-duché de Luxembourg, 2019; Ministry of ecological transition and territorial cohesion, 2019; Plan national énergie - climat intégré, 2019; The Dutch government, 2019)

Country	Target	Greenhouse gas emission limits, compared to 1990, %	Share of renewables in gross final energy consumption, %	Share of renewables in transport, %	Primary energy consumption, Mtoe	Final energy consumption, Mtoe
EU	2020	-20%	20%	10.20%	1483	959
	2030	At least -55%	32%	29%	992.5	763
	Implementation 2020	-20%	22%	10.30%	1235.8	906.3

AT	2020	-20%	34%	11.40%	31.5	25.1
	2030	-40%	45%	14%	30.8	25.6
	Implementation 2020	-6%	36.50%	10.3%	29.7	26.1
BE	2020	-30%	13%	10.14%	43.70	32.50
	2030	-55%	17.50%	14%	39	33.1
	Implementation 2020	-25.56%	13%	11.0%	43.90	33.30
FR	2020	-19%	23%	10.50%	226.40	137.9
	2030	-37%	>=33%	14%	202.9	120.9
	Implementation 2020	-5.41%	19.10%	9.2%	208.4	130.1
DE	2020	-40%	18%	13.2	276.6	194.3
	2030	EU Target level	40%	28%	240	185
	Implementation 2020	-41.05%	19.30%	10.01%	262.3	201.7
LU	2020	EU Target level	11%	10%	4.5	4.2
	2030	EU Target level	25%	18%	N/A	3.6
	Implementation 2020	2.5%	11.70%	12.6%	3.9	3.8
NL	2020	-25%	14%	10.30%	60.7	52.2
	2030	-49%	27%	28%	46.6	43.9
	Implementation 2020	-24.58%	14%	12.6%	58.4	45.5

According to the analysis of reduction targets for 2020 compared to 1990 levels for western Europe, as shown in Table 2, Germany (DE) and almost the Netherlands (NL) have successfully exceeded their reduction goals. Germany has achieved a remarkable reduction of 41.05%, followed by the Netherlands with a 24.58% reduction. France (FR) could not reach its target with a 5.41% reduction, while its target for 2020 was a 19% reduction. Also, Austria (AT), Belgium (BE), and Luxembourg (LU) had targets of 20%, 30%, and 20% reduction, but they fell short of their goals, achieving only 6%, 25.56%, and 2.5% reductions, respectively. Also, Austria and France have set their sights on reducing emissions by 40% and 37%, respectively, while Belgium has set a target of 55% by 2030. Germany and Luxembourg aim for even steeper cuts of 55% each, and the Netherlands has set a target of a 49% reduction by 2030. These national targets are notably more stringent than the overarching E.U. goal of a 55% reduction by 2030, thereby highlighting the commitment of these countries toward mitigating climate change.

Moreover, upon examining the renewable energy targets for 2020 across European countries, it is evident that the achievement landscape is quite varied. Austria sets itself apart as the

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frontrunner, exceeding its target significantly with a remarkable 36.50% share. France and Germany also achieved impressive shares of 19.10% and 19.30%, respectively, although they fell short of their respective goals. On the other hand, the Netherlands lagged with the lowest share of 14.00%. Belgium and Luxembourg, however, were able to achieve their specific targets of 13% and 11%, respectively, with shares of 13.00% and 11.70%. These findings demonstrate the diverse success rates of European countries in meeting their renewable energy targets for 2020. The table also outlines ambitious targets for renewable energy in 2030. Austria has set the highest target to achieve a 45% share of renewable energy, followed by Germany at 40%. France aims for a minimum of 33% renewable energy, while the Netherlands has a target of 27%. Belgium and Luxembourg have set more modest targets of 17.50% and 25%, respectively. Also, in 2020, the EU collectively achieved its target of 10.3% renewable energy use in transport, which surpassed the original goal of 10.2%. However, the results of individual countries were mixed. Among the member states, Luxembourg performed exceptionally well by exceeding its 10% target and achieving 12.6% renewable energy use in transport. Similarly, the Netherlands surpassed its 10.3% goal and achieved 12.6%, while Belgium exceeded its 10.14% target and achieved 11.0%. In contrast, France fell short of its 10.5% target by achieving only 9.2%. Germany, which had set an ambitious target of 13.2%, achieved 10.01% renewable energy use in transport. Austria also missed its target by reaching 10.3% compared to the aimed-for 11.4%. These results demonstrate that while some countries have made significant progress in renewable energy use in transport, others still have a long way to go to meet their targets. Also, table 2 delineates the projected targets for the proportion of renewable energy sources in transportation for each E.U. member state by 2030. Notably, most countries have set their sights on achieving a range between 14% and 28%, with Austria, Belgium, and France aiming for the lower end of the scale at 14%. At the same time, Germany and the Netherlands have adopted a more ambitious approach, outlining targets of 28%. Luxembourg has set a target of 18%, placing it in the middle of the range.

Moreover, regarding energy efficiency targets, Germany's primary and final energy consumption stats were 262.3 and 201.7 Mtoe in 2020, while its targets for 2020 were 276.6 and 194.4 Mtoe. The same stats were for France at 208.4 and 130.1 Mtoe and the Netherlands at 58.4 and 45.5 Mtoe in 2020, while France's targets for primary and final energy consumption stats were 226.40 and 137.9 Mtoe, and the Netherlands' targets were 60.7 and 52.2 Mtoe in 2020. Austria's primary and final energy consumption stats were 29.7 and 26.1 Mtoe in 2020, while its targets for 2020 were 31.5 and 25.1 Mtoe. The same stats were for Belgium at 43.90

and 33.30 Mtoe and Luxembourg at 3.9 and 3.8 Mtoe in 2020, while Belgium's targets for primary and final energy consumption stats were 43.70 and 32.50 Mtoe, and Luxembourg's targets were 4.5 and 4.2 Mtoe in 2020. On top of that, western European countries have various targets for primary energy consumption for 2030, varying from 240 Mtoe for Germany to 30.8 Mtoe for Austria. Also, various targets for final energy consumption are set for 2030, varying from 185 Mtoe for Germany to 3.6 Mtoe for Luxembourg.

4.1.3. Central and Eastern Europe

Table 3 outlines climate and energy targets for central and eastern European countries, highlighting their performance in GHG reductions, renewable energy adoption, and energy efficiency.

Tab. 3 - Central and Eastern Europe targets. Created by authors based on references (European Commission, 2020c, 2020d, 2020f, 2020s, 2020u, 2020v; Ministerstwo Energii, 2019; Ministry of energy, 2019; Ministry of environment and energy, 2019; Slovak ministry of the economy, 2019; The Czech government, 2019; The Slovenian government, 2019)

Country	Target	Greenhouse gas emission limits, compared to 1990, %	Share of renewables in gross final energy consumption, %	Share of renewables in transport, %	Primary energy consumption, Mtoe	Final energy consumption, Mtoe
EU	2020	-20%	20%	10.20%	1483	959
	2030	At least -55%	32%	29%	992.5	763
	Implementation 2020	-20%	22%	10.30%	1235.8	906.3
BG	2020	EU Target level	16%	7.80%	16.9	8.6
	2030	-40%	27%	14%	17.5	10.3
	Implementation 2020	-51.40%	23.30%	9.1%	17.20	9.50
HU	2020	-20%EU Target level	13%20%	10.00%10%	26.610.7	18.27.0
	2030	-40%-31.2%	21%42.50%	29%13.20%	N/A8.23	18.76.85
	Implementation 2020	-33.74%-24.67%	13.90%31%	11.6%6.6%	23.97.80	18.06.5
CZ	2020	EU Target level	13%	10.80%	44.3	25.3
	2030	-80%	22%	14%	41.43	23.65
	Implementation 2020	-43.36	17.30%	9.4%	37.5	24.5
PL	2020	EU Target level	15%	10.14%	96.4	71.6
	2030	-35%	23%	14%	91.3	67.1
	Implementation 2020	-21.50%	16.10%	6.6%	96.9	71.1

SK	2020	EU Target level	14%	10%	16.4	10.4
	2030	EU Target level	19.20%	27%	15.7	10.3
	Implementation 2020	-49.54%	17.30%	9.3%	15.2	10.4
SI	2020	EU Target level	25%	10%	7.1	5.1
	2030	-30%	27%	21%	6.4	4.7
	Implementation 2020	-15.10%	25%	10.9%	6.10	4.4

According to Table 3, most central and eastern Europe states surpassed expectations in 2020, including Bulgaria with a significant 51.40% reduction, Slovakia at 49.54%, the Czech Republic at 43.36%, Poland at 21.50%, and Hungary at 33.74%. However, Slovenia could not exceed its target, with a 15.10 reduction. This success story marks a critical milestone in the EU's continued commitment to mitigating the adverse effects of climate change and reducing its carbon footprint. Also, these countries have set targets for greenhouse gas emission reduction by 2030 relative to 1990 levels. The severity of these targets varies among nations, with the Czech Republic aiming for an 80% reduction, while Slovenia has set the lowest goal of a 30% reduction.

Moreover, in 2020, central and eastern European countries could surpass their renewable energy targets in gross final energy consumption. Specifically, Bulgaria achieved a renewable energy share of 23.30%, which exceeded its target of 16%. Hungary achieved a renewable energy share of 13.9%, which exceeded its target of 13%. The Czech Republic achieved a renewable energy share of 17.30%, which exceeded its target of 13%. Similarly, Poland achieved a renewable energy share of 16.10%, which exceeded its target of 15%. Slovakia achieved a renewable energy share of 17.30%, exceeding its target of 14%. Lastly, Slovenia achieved a renewable energy share of 25%, which was precisely its target. Also, the presented table provides valuable insights into the target share of renewables in final energy consumption for central and eastern European countries in 2030. The EU has set an ambitious target of 32% renewables, with individual country targets ranging from 19.20% for Slovakia to 27% for Poland. Furthermore, the specific targets for Bulgaria at 27%, the Czech Republic at 22%, Poland at 23%, and Slovenia at 27% reflect the diverse renewable energy landscape across E.U. member countries. Moreover, in 2020, the EU successfully attained its target of achieving 10% renewable energy use in transport, with all but two of the central and eastern European countries meeting the goal. Slovenia emerged as the frontrunner with 10.9%, followed by Bulgaria (9.1%), the Czech Republic (9.4%), and Slovakia (9.3%). However, Poland fell short at 6.6%. The data pertains to the year 2020; more recent statistics indicate that the EU has slightly fallen below the 10%

target. Also, according to the table, the EU has set a target share of 29% to be achieved by 2030. However, in 2020, all central and eastern European countries except Slovenia (SI) failed to reach the 10% target. Slovenia was the only country that achieved the target, with a share of 10%. Meanwhile, Bulgaria achieved 9.1%, Hungary achieved 11.6%, the Czech Republic achieved 14%, and Poland achieved 14%. These figures demonstrate the need for more significant efforts to meet the EU’s renewable energy targets.

Regarding energy efficiency targets, Poland’s primary and final energy consumption stats were 96.9 and 71.1 Mtoe in 2020, while its targets for 2020 were 96.4 and 71.6 Mtoe. The same stats were for the Czech Republic at 37.5 and 24.5 Mtoe and Bulgaria at 17.20 and 9.50 Mtoe in 2020, while the Czech Republic’s targets for primary and final energy consumption stats were 44.3 and 25.3 Mtoe, and Bulgaria's targets were 16.9 and 8.6 Mtoe in 2020. Slovakia’s primary and final energy consumption stats were 15.2 and 10.4 Mtoe in 2020, while its targets for 2020 were 16.4 and 10.4 Mtoe. The same stats were for Hungary at 23.19 and 18 Mtoe and Slovenia at 7.1 and 5.1 Mtoe in 2020, while Hungary’s targets for primary and final energy consumption stats were 26.6 and 18.2, and Slovenia’s targets were 7.1 and 5.1 Mtoe in 2020. Moreover, these countries have various targets for primary energy consumption for 2030, varying from 91.3 Mtoe for Poland to 6.4 Mtoe for Slovenia. Also, various targets for final energy consumption are set for 2030, varying from 67.1 Mtoe for Poland to 4.7 Mtoe for Slovenia.

4.1.4. Southern and Northern Europe

Table 4 compares climate and energy targets for southern and northern European countries, highlighting their performance in GHG reductions, renewable energy adoption, and energy efficiency.

Tab. 4 - Southern and Northern Europe. Created by authors based on references (Department of environment, 2019; European Commission, 2020e, 2020l, 2020m, 2020n, 2020o, 2020t, 2020w; Goverment of Ireland, 2019; Goverment of Portugal, 2019; Goverment of Spain, 2019; Ministry of economic development, 2019; The Hungarian government, 2019; ΥΠΟΥΡΓΕΙΟ ΠΕΡΙΒΑΛΛΟΝΤΟΣ & ΕΝΕΡΓΕΙΑΣ, 2019)

Country	Target	Greenhouse gas emission limits, compared to 1990, %	Share of renewables in gross final energy consumption, %	Share of renewables in transport, %	Primary energy consumption, Mtoe	Final energy consumption, Mtoe
EU	2020	-20%	20%	10.20%	1483	959
	2030	At least -55%	32%	29%	992.5	763

	Implementation 2020	-20%	22%	10.30%	1235.8	906.3
CY	2020	EU Target level	13%	4.90%	2.2	1.9
	2030	EU Target level	>=23%	14%	2.4	2
	Implementation 2020	39.72%	16.90%	7.4%	2.2	1.6
EL	2020	EU Target level	18%	10.50%	24.7	18.4
	2030	EU Target level	>=35%	32%	20.55	16.51
	Implementation 2020	-27.88%	21.70%	5.3%	19.2	14.5
HU HR	2020	EU Target level--20%	20%13%	10%10.00%	10.726.6	7.018.2
	2030	-31.2%--40%	42.50%21%	13.20%29%	8.23N/A	6.8518.7
	Implementation 2020	-24.67%--33.74%	31%13.90%	6.6%%11.6%	7.8023.9	6.518.0
IE	2020	EU Target level	16%	10.00%	13.9	11.7
	2030	-45%	51%	14%	13.7	11.2
	Implementation 2020	6.2%	16.20%	10.2%	13.4	11.2
IT	2020	-20%	17%	10.14%	158.00	124.00
	2030	-40%	40%	22%	125.1	103.8
	Implementation 2020	-26.06%	20.40%	10.7%	132.3	102.7
PT	2020	EU Target level	31%	10%	22.5	17.4
	2030	EU Target level	47%	38%	21.15	14.5
	Implementation 2020	-2.4%	34%	9.7%	19.5	15.0
ES	2020	EU Target level	20%	13.60%	123.4	86.3
	2030	-23%	48%	22%	98.5	73.6
	Implementation 2020	-4.71%	21.20%	9.5%	105.0	73.8

Table 4 shows the greenhouse gas emissions reduction targets the northern and southern European countries set for 2020. Cyprus reached a 39.72% reduction from the 1990 levels, Greece (27.88 reduction), Croatia (24.67% reduction),, and Italy (26.06 reduction) exceeded their targets significantly. However, Spain, with a 4.71 reduction, Portugal (2.4 reduction), and Ireland, with a 6.2 increase, did not achieve their targets for 2020. The table also presents an overview of the GHG emission reduction targets set for various northern and southern states by 2030, compared to the recorded levels in 1990. Ireland has taken the lead with the most ambitious target of reducing its emissions by 45%, while Cyprus, Greece, and Portugal set E.U. targets as national targets. Also, Croatia and Italy have set a target of a 31.2% and 40% reduction in their greenhouse gas emissions by 2030, while Spain has set a target of a 23% reduction by 2030.

Furthermore, several member states also exceeded their targets for the share of renewables in gross final energy consumption in 2020. Cyprus achieved 16.9% against its target of 13%, Greece achieved 21.7% as compared to its 18% target, Italy achieved 20.4% against its 17% target, Portugal went up to 34% compared to its 31% target, and Spain achieved 21.2% against its target of 20%. Croatia could also meet its target of 20%, while Ireland could not reach its 16% target, achieving only 16.2%. Also, the presented table provides valuable insights into the target share of renewables in final energy consumption for northern and southern Europe. As mentioned, the EU has set an ambitious target of 32% renewables, with individual country targets ranging from 42.50% for Croatia to 51% for Ireland. Furthermore, the specific targets for Cyprus and Greece are at least 23% and 35%, respectively. Italy at 40% and Portugal at 47% show various renewable energy targets across the EU. On top of that, in 2020, the proportion of renewable energy sources utilized in transportation varied among the EU countries examined, ranging from 5.3% in Greece to 6.6% in Croatia. Greece, Spain, and Portugal did not meet their goals, with rates of 5.3%, 9.5%, and 9.7%, respectively, whereas their objectives were 10.50%, 13.60%, and 10.00%. Italy (10.7%) exceeded its target of 10.14%. Ireland (10.2%) accomplished its respective goals of 10%, while Cyprus accomplished its goal of 4.9% by achieving a proportion of 7.4%. Also, they have set different national goals for the share of renewable energy used in their transportation sector by 2030. Portugal has set the highest target of 38%, followed by Greece at 32%. Croatia has a target of 13.2%, while Spain and Italy aim for 22%. Some countries, including Cyprus and Ireland, are likely aiming to meet the minimum threshold of 14% as stipulated by the E.U. directive.

Moreover, regarding energy efficiency targets, Italy's primary and final energy consumption stats were 132.3 and 102.7 Mtoe in 2020, while its targets for 2020 were 158.00 and 124.00 Mtoe. The same stats were for Spain at 105.0 and 73.8 Mtoe and Portugal at 19.5 and 15.0 Mtoe in 2020, while Spain's targets for primary and final energy consumption stats were 123.4 and 86.3 Mtoe, and Portugal's targets were 22.5 and 17.4 Mtoe in 2020. Croatia's primary and final energy consumption stats were 7.8 and 6.5. The same stats were for Greece at 19.2 and 14.5 Mtoe and Ireland at 13.4 and 11.2 Mtoe in 2020, while Greece's targets for primary and final energy consumption stats were 24.7 and 18.4 Mtoe, and Ireland's targets were 13.9 and 11.7 Mtoe in 2020. Cyprus's primary and final energy consumption stats were 2.2 and 1.6 Mtoe in 2020, while its targets for 2020 were 2.2 and 1.9 Mtoe. On top of that, these countries have various targets for primary energy consumption for 2030, varying from 125.1 Mtoe for Italy to

2.4 Mtoe for Cyprus. Also, various targets for final energy consumption are set for 2030, varying from 103.8 Mtoe for Italy to 2 Mtoe for Cyprus.

4.2 Multicriteria analysis

The CRITIC-SAW method ranks E.U. countries according to their performance in achieving national targets. Table 5 presents data on key indicators such as GHG emissions reduction, RES, renewable energy in transport (RES-T), and energy consumption metrics. The table does not provide rankings; it is the decision-making matrix. These values were later normalized and processed to determine success rates for national targets.

Tab. 5 - Decision matrix. Source: own research

	GHG	RES	RES-T	PEC	FEC
EU	1.00	1.10	1.01	0.94	0.95
Austria	0.30	1.07	0.90	1.06	0.96
Belgium	0.85	1.00	1.08	1.00	0.98
Bulgaria	2.57	1.46	1.17	0.98	0.91
Czechia	2.17	1.33	0.87	1.18	1.03
Denmark	1.18	1.02	0.96	1.14	1.15
Germany	1.03	1.08	0.76	1.05	0.96
Estonia	3.58	1.21	1.22	1.28	1.05
Ireland	-0.31	1.01	1.02	1.04	1.05
Greece	1.39	1.21	0.50	1.28	1.27
Spain	0.24	1.06	0.70	1.18	1.17
France	0.28	0.83	0.88	1.09	1.06
Croatia	1.23	1.55	0.66	1.38	1.08
Italy	1.30	1.20	1.06	1.19	1.21
Cyprus	-1.99	1.30	1.51	1.02	1.22
Latvia	2.97	1.05	0.67	1.26	1.16
Lithuania	2.94	1.17	0.55	1.04	0.81
Luxembourg	-0.13	1.06	1.26	1.14	1.11
Hungary	1.69	1.07	1.05	1.11	1.01
Netherlands	0.98	1.00	1.22	1.04	1.15
Poland	1.08	1.07	0.65	1.00	1.01
Portugal	0.12	1.10	0.87	1.15	1.16
Slovenia	0.76	1.00	1.09	1.16	1.17
Slovakia	2.48	1.24	0.93	1.08	1.00
Finland	1.63	1.15	0.72	1.20	1.15
Sweden	0.88	1.23	2.31	1.04	0.98

Table 6 presents the criteria weights determined using the CRITIC method. GHG emissions hold the highest weight (0.234224), reflecting its strong impact on the final rankings.

Tab. 6 - Criteria weights. Source: own research

Criteria	GHG	RES	RES-T	PEC	FEC
Weights	0.234224	0.165807	0.197636	0.193708	0.208625

Subsequently, the SAW method ranks countries according to weighted criteria. The final results are shown in Figure 1, which illustrates the final ranking of countries based on the CRITIC-SAW methodology. Estonia ranks first, followed by Latvia and Bulgaria. On the other hand, Cyprus, Ireland, and France rank the lowest, reflecting weaker progress in meeting their climate targets.

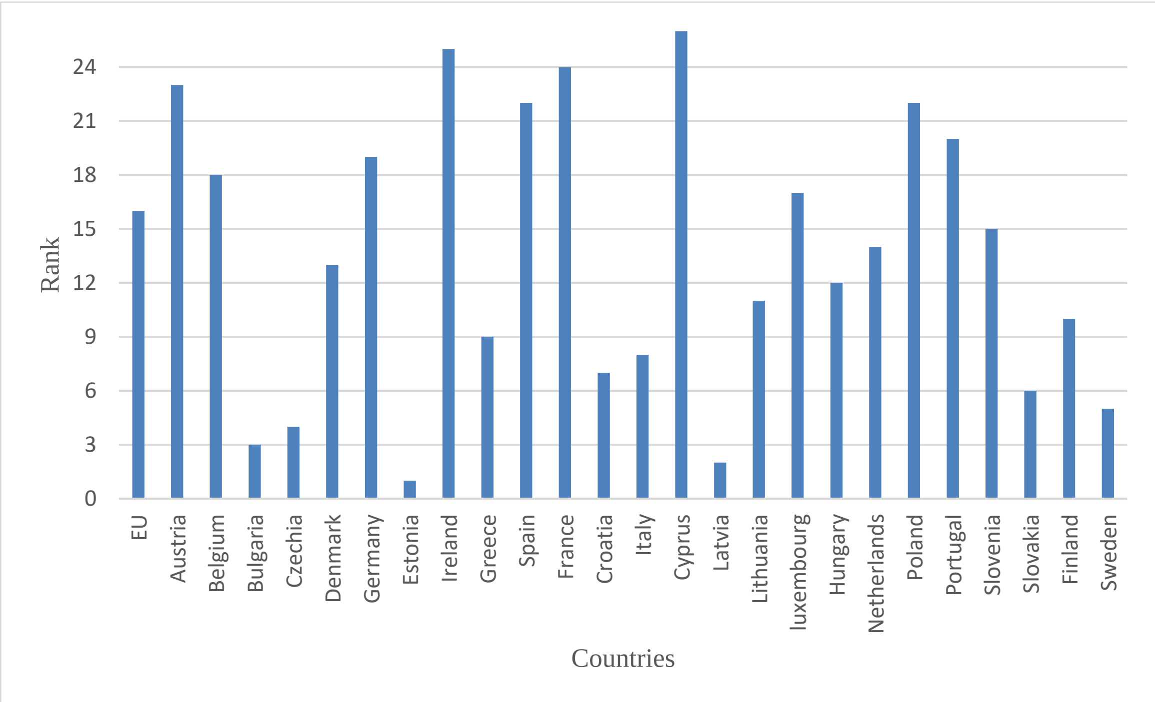

Fig. 1 – Countries' ranks. Source: own research

5 DISCUSSION

This study indicated how different E.U. countries use policies to support their energy transitions. It highlighted the best-performing countries that can be examples for others facing challenges. For instance, by implementing strong policies, Estonia and Latvia could attract more investment. Consequently, they can boost innovation and competitiveness. However, Cyprus would deal with higher energy costs and economic risks, hindering innovation. Therefore, it can be concluded that NECPs should be effectively implemented to reduce emissions and stay competitive in the economy.

Moreover, policymakers and industry leaders can consider the present study to find issues in developing strategies and plans, improve resource use, and adjust policies to boost national and regional competitiveness in the clean energy sector. This paper could be useful in assessing sustainability by combining systematic review methods with decision-making models. Additionally, this study offered a clear framework that can be used for future evaluations of NECPs and similar policies outside the EU.

Furthermore, this study expanded on prior research by providing a comprehensive, quantitative assessment of all E.U. countries' performance in achieving NECP targets. In contrast, Streimikiene et al. (2022) focused only on the Baltic states, and Zell-Ziegler et al. (2021) analyzed energy sufficiency in select countries. Maris and Flouros (2021) studied the adoption of the green deal; however, this study evaluated and ranked national success rates rather than policy adoption. Also, Gkonis et al. (2020) proposed an energy-efficiency policy framework. However, this study empirically measured its impact alongside renewable energy and GHG reductions. Newbery (2021) studied grid constraints in renewable energy adoption, but the present study highlighted how policy effectiveness can drive success beyond technical limitations.

Also, this section analyzes the results by categorizing countries based on their performance in achieving their NECP targets. The discussion is divided into three parts: (1) leading countries that have significantly reduced greenhouse gas (GHG) emissions and successfully implemented renewable energy policies, (2) moderate performers that show strong policy commitments but face certain implementation challenges, and (3) low-performing countries that struggle to meet their targets and encounter structural and policy-related obstacles in their energy transition efforts.

5.1. Leading Countries in Renewable Energy and GHG Reduction

According to the results, success in reducing GHG compared to 1990 levels is the most influential criterion impacting countries' performance, meaning countries with a more significant reduction in GHG would have a better rank compared to other countries with a lower reduction. Estonia ranked first as the country with a significant reduction in GHG, though its performance concerning other criteria is also noticeable. Estonia is leading the way in using renewable energy for district heating in the Baltics. It promotes this through support schemes, focusing on efficient cogeneration and infrastructure upgrades. The country’s transportation sector is also noteworthy for its high utilization of renewable biomethane from domestic waste. Moreover, existing policies encourage biofuel use and adoption of electric vehicles. Estonia has already surpassed expectations with a high share of renewables in transportation by 2020, and it has ambitious plans for further progress (European Commission, 2020h; Majandus- ja Kommunikatsiooniministeerium, 2019).

5.2. Moderate Performers with Strong Policy Commitments

Latvia was ranked second, another Baltic country. However, Latvia is still lagging in adopting renewables in transportation. The NECP of Latvia recognizes the importance of implementing strong policies to encourage using renewable energy sources in transport. The current focus is reducing dependence on private vehicles by promoting public transport and other means. The plan also identifies the potential of biogas and biomethane as alternative energy sources. It highlights the need for biogas purification facilities and the widespread use of biomethane in vehicles, indicating a long-term vision for biomethane in public and commercial transport.

The NECP of Latvia demonstrates a robust commitment to energy efficiency in district heating. It presents a two-pronged approach, aiming to reduce overall energy consumption through improved efficiency measures and increase the use of renewable energy sources in district heating production. The plan also underscores the importance of improving energy efficiency in local and individual heating systems, ensuring a sustainable and efficient heating system for the future (Ekonomikas ministrija, 2019; European Commission, 2020p).

5.3. Low-Performing Countries and Key Challenges in Energy Transition

On the other hand, Cyprus is the worst country according to its success rate in achieving national targets, mainly because of a significant increase in GHG emissions compared to 1990 levels. Cyprus has developed an NECP that outlines an ambitious strategy to significantly increase renewable energy sources and improve energy efficiency across all sectors from 2020 to 2030. The primary sources of renewable energy will be solar and wind power. The plan aims to invest in large-scale solar farms, rooftop solar installations for homes and businesses, and wind farm development. Additionally, the NECP emphasizes the need for stricter building codes and renovations to improve energy efficiency in buildings. This plan includes using better insulation materials, promoting energy-efficient appliances, and implementing more innovative building management systems.

However, the NECP acknowledges some challenges of transitioning to a more renewable energy-reliant future. One of the major hurdles is the limitation of energy storage solutions. As the proportion of solar and wind power in the energy mix increases, these intermittent sources create a need for adequate storage to maintain grid stability. The plan also discusses strategies to manage fluctuations in renewable energy generation and ensure a reliable energy supply despite the inherent variability of solar and wind power. Despite these challenges, Cyprus's NECP demonstrates a solid commitment to reducing dependence on fossil fuels and mitigating climate change by focusing on expanding renewable energy sources and improving energy efficiency across all sectors (Department of Environment, 2019).

6 CONCLUSIONS AND POLICY IMPLICATIONS

The EU has implemented measurable targets for sustainable development, which have proven effective in tracking progress and guiding national efforts. This study examined how these targets benefit researchers, policymakers, and planners at the implementation level. Clearly defined targets allow researchers to objectively compare national efforts and assess progress toward achieving sustainable, innovative, and inclusive growth across E.U. member states. The study also analyzed target achievement and corresponding NECPs to delve deeper into each country's policies and measures. This granular approach comprehensively assesses national efforts in energy, transportation, and agriculture sectors, which are crucial for achieving climate change and energy goals.

Additionally, analyzing the implementation of targets goes beyond simply measuring progress. It serves as a starting point for further development of environmental policies. Policymakers can strategically adjust or introduce new initiatives by identifying areas where existing strategies fall short. It allows them to focus on areas with the most significant environmental impact, particularly those that reduce greenhouse gas emissions. The EU's target-setting approach promotes transparency and accountability, empowering nations to refine their strategies for a more sustainable future.

Based on the findings, each EU member state must take responsibility for preparing a NECP and establishing attainable climate goals while implementing meaningful measures and policies to achieve them. It is essential to have a comprehensive view of the policies and measures needed to reach these climate targets. The NECP should provide details on the impact of the policies, highlighting which measures are of high significance and which are of low importance. Additionally, evaluating how energy policies impact the effectiveness of the overall policy and the level of development can be done using relevant indicators. Multicriteria analysis and composite index methods are widely accepted and recognized as the most appropriate methods to measure the promotion of energy efficiency across various socioeconomic sectors.

The present study could also be useful for non-E.U. countries by offering a comprehensive framework that helps policymakers develop energy strategies. For instance, non-E.U. countries could avoid common mistakes, helping them to make more accurate plans. Moreover, any country can use CRITIC-SAW to evaluate its performance and compare it with its peers.

6.1. Policy implications

In order to reach the target set for 2030, new policies should be developed to include sectors currently not covered by the emissions trading system (ETS). These sectors, including agriculture, buildings, and transportation, could greatly benefit from specific interventions such as subsidies for electric vehicles, regulations requiring energy-efficient building practices, and implementing carbon taxes in specific industries. National climate targets for 2030 should be more ambitious, aligning them with the levels outlined in the energy strategy and climate plans (ESRs) to accelerate the nation's decarbonization trajectory. A two-pronged strategy is necessary to achieve 100% renewable electricity. First, we should implement national energy efficiency initiatives to reduce electricity demand. Then, we should diversify the national energy mix by increasing reliance on renewable sources such as solar, wind, and geothermal power. This strategy would significantly reduce our dependence on fossil fuels.

Some national plans require a detailed roadmap to reach the set targets. It is highly recommended that a thorough plan with specific policies connected to reducing emissions be developed to address this critical issue. Each policy should have measurable targets and a robust monitoring system to track progress effectively. Setting a national economy-wide climate target for 2030 and specific sectoral targets is essential to achieve a more comprehensive approach to national climate action. This framework will ensure that each sector makes a proportional contribution and provides a clear roadmap for reaching national climate goals.

It is recommended that detailed descriptions of each PAM be provided in order to build trust and ensure effectiveness. These descriptions should include the activities involved, a quantified assessment of their expected impact on greenhouse gas emissions, and a clearly defined method for monitoring progress and evaluating policy effectiveness. Refocusing national efforts on decarbonization is essential, especially in the transportation sector. Investing in electric vehicles, expanding public transportation, and exploring sustainable solutions are vital to meeting climate targets. Implementing well-defined, specific measures with clear timelines for implementation and rigorous impact assessments is recommended. Vague or overly broad measures hinder progress and make evaluation easier. Additionally, the utilization of outdated or conflicting information should be avoided.

6.2. Limitations and future research

Romania and Malta were excluded due to missing data. Quantitative indicators may ignore policy effectiveness and socioeconomic constraints. Therefore, future research could address these through qualitative case studies. Focusing only on E.U. states limits how we can apply findings globally. By expanding to non-E.U. areas, we can gain better insights into effective practices. Also, CRITIC-SAW can not include the interconnections of NECP pillars. Therefore, future studies should adopt dynamic models to overcome this shortcoming.

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